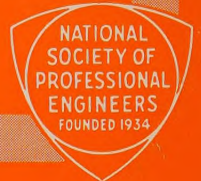


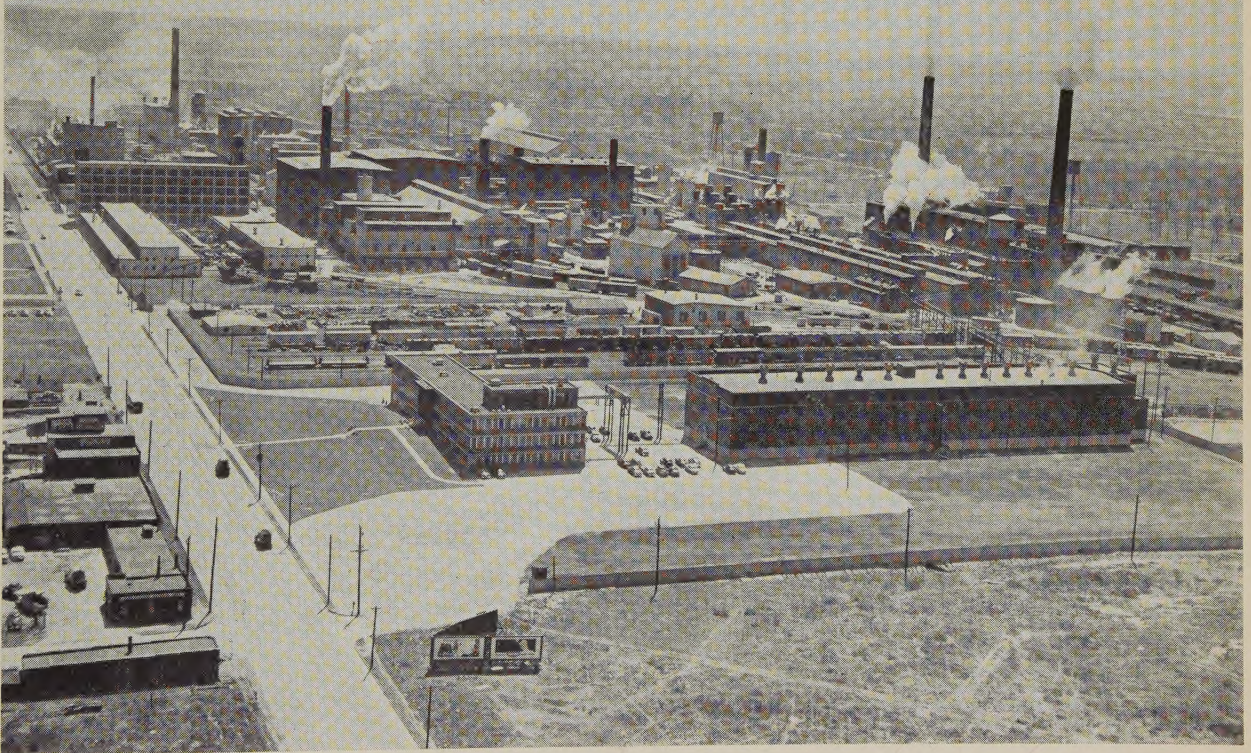
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the **ILLINOIS ENGINEER**



"The Impact of Oil on Our Economy," in This Issue

**ANNUAL MEETING
East St. Louis
March 25-26-27**



**"INDUSTRIAL EAST ST. LOUIS WELCOMES YOU"
ANNUAL MEETING, 1954**



THE ILLINOIS ENGINEER, FEBRUARY, 1954—VOLUME XXX, NO. 2

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Affiliated with the National Society of Professional Engineers

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Of Professional Interest

THE ILLINOIS ENGINEER—THIS MONTH

NATIONAL ENGINEERS' WEEK

February 21-27, 1954

"I heartily endorse this recognition of the engineering accomplishments of our Nation's first President, and I am delighted to use this occasion to pay compliments to America's engineers."

DWIGHT D. EISENHOWER

As has been the case for a number of years, the National Society of Professional Engineers is sponsoring a National Engineers' Week during the week in which February 22, Washington's birthday, occurs. Radio and TV programs and magazine and newspaper articles, explaining the significance of engineers and engineering to our modern way of life, will be presented throughout the week. Call these articles and programs to the attention of your lay friends. Here is an opportunity to forward one of the primary purposes of the N.S.P.E.—educating the public concerning the work of the engineering profession.

W. A. OLIVER, Editor

SCHEDULE OF MINIMUM FEES AND SALARIES

In its report given at the 67th Annual Meeting, the Committee on Fees and Salaries recommended that a schedule of Recommended Minimum Salaries be published periodically in THE ILLINOIS ENGINEER.

Quoting from the report, "This schedule should be computed by applying the current cost of living index of the U. S. Department of Labor to the schedule that was adopted by the Illinois Society of Professional Engineers and published in the Second edition of the Schedule of Minimum Fees and Salaries for General Engineering Services." The schedule follows:

MINIMUM SALARIES FOR ENGINEERS WITHIN THE
STATE OF ILLINOIS, EFFECTIVE FROM JANUARY,
1954 TO JULY, 1954

Grade 1.....	\$ 3,964.00 to \$ 5,153.20
Grade 2.....	5,153.20 to 6,342.40
Grade 3.....	6,342.40 to 7,729.80
Grade 4.....	7,729.80 to 8,919.00
Grade 5.....	8,919.00 to 10,504.60
Grade 6.....	10,504.60 to 11,892.00
Grade 7.....	11,892.00 to 14,865.00
Grade 8.....	14,865.00 to 19,820.00
Grade 9.....	19,820.00 upward

The above schedule has been prepared by G. L. DeMent, Chairman, Committee on Fees and Salaries.

PRESIDENT'S MESSAGE

The week of February 21 through 27th is traditionally chosen as "National Engineers' Week" in commemoration of George Washington, the first President of the United States, who was a notable Engineer.

"National Engineers' Week" is an annual observance, inaugurated by the National Society of Professional Engineers, to bring to the attention of the American people the role of the Professional Engineer in society and his vital function in furthering a high standard of living, safety, progress and welfare in the world.

While unique as an American custom, the matter of setting aside a week of particular note of accomplishment or celebration, "National Engineers' Week" to the Professional Engineer in a sense might be called "Emphasis Week of Engineering Achievements." We might say emphasis week because we are only emphasizing the achievements that are in reality of daily consequence to the Profession. It is a matter of every-day contribution to the well-being and protection of the life, health and property of the people. We might say that every week is "Engineers' Week" to the public concern. Thus, it should be to this realization that each of us, of the Profession, continue through the entire year the aims of the "National Engineers' Week," which is to do the much-needed job of telling the people about the thousands and thousands of ways in which engineering affects them in their daily lives.

Along with the publicity are the many public-interest activities of our State and National Societies, which should be broadcast to the public. These items are numerous and are within easy reach of every member. Reference to the items can be made to the issues of this magazine, the "American Engineer," local, State and National officers' reports, as well as the constant flow of reports of the State and National headquarters, which are directed to your chapter officers.

As a "Public Relations Service," the National Society of Professional Engineers has, for distribution to interested Engineers, the third in a series of Executive Research Surveys known as "How to Attract and Hold

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READ THE ADVERTISEMENTS

SUBSCRIPTION RATES

\$2.00 per year in advance to members of the Illinois Society of Professional Engineers. \$4.00 per year in advance to non-members in U.S.A. and possessions, Canada, and Mexico. Foreign \$6.00. Single copies 40c.
Published by the Illinois Society of Professional Engineers, Inc., at 631 East Green Street, Champaign, Illinois.
Entered as Second Class Matter April 27, 1949, at the Post Office, Champaign, Illinois.

Engineering Talent." The report is much more than a guide to management on "how to better understand its engineers." It goes deeply into the Engineer's motivation; it explores his attitude towards his job, his boss, his profession, and the union question.

Thanks to Editor Professor William A. Oliver and the contributors of the many fine articles of our three previous issues of THE ILLINOIS ENGINEER pertaining to the work of our fine committees. It is certain that these articles gave the general membership a better idea of the work being done by the committees producing a basis of reference to activities of our Societies.

As a reminder to the Membership Campaign: "Don't forget! A large felt banner with the name of the lucky chapter inscribed thereon is being donated by me, as your State President, in this "Your Membership Campaign." The banner will be presented at the Annual Convention in East St. Louis to the chapter obtaining the most new members. The campaign began November 20th with the scoring ending March 20th. Thanks to Earl W. Markwardt, Chairman, and K. C. Hoeglund, Co-Chairman of the Membership Committee, the Chapter Membership Chairmen and Committees, and to the participation of each of you in the campaign. LET'S HIT THE FINISH LINE WITH A B-A-N-G!

I'll be seeing you, I hope!—at the 69th Annual Convention at East St. Louis, March 25, 26 and 27.

RAYMOND G. BRICHLER, President, I.S.P.E.

COST OF LIVING INDEX

The cost of living correction factor to be applied to the I. S. P. E. Schedule of Minimum Fees and Salaries was 192.3 for November, 1953. This factor is based upon a 1935-39 average taken as 100.

At the present time the Bureau of Labor Statistics is basing its Consumer Price Index upon a 1947-49 average. The figure of 192.3 given above has been converted from this average. This would seem to be the logical method of presentation until the Society publishes a new Fees and Salaries Schedule established upon the 1947-49 base.

RESULTS OF THE 1954 ELECTION

The polls closed at 5:00 p. m. January 15th, the Tellers Committee met in the Executive Secretary's office at 2:00 p. m. January 19th and the report shows the following results: President—Clarence W. Klassen; Vice-President—Dwain M. Wallace. Tellers Committee: C. Dale Greffe, Chairman, M. H. Kinch, W. J. Roberts.

DATE OF REGISTRATION EXAMINATIONS ANNOUNCED

The next examination for registration as Professional Engineer in Illinois will be given on May 11 and 12, next.

NEW CHAPTER OFFICERS LISTED

Insofar as they were available at press time, the chapter officers for 1954 have been presented on the inside front cover of this issue. These officers are key figures in the successful conduct of your chapter business. Give them your hearty support in order that the affairs of the Society may move at an accelerated pace during 1954.

LETTERS FROM VEEP KLASSEN TO EDITOR OF THE STATE REGISTER, SPRINGFIELD

Dear "Admiral":

Greetings from the South China Sea. Am transplanting the Illinois health and sanitation standards in this newly-developed country. I am serving on a three-month United Nations assignment as Sanitary Engineering Consultant to the British Colonial Service in Borneo, in addition to several other countries in the East.

It is a most interesting country, surprisingly primitive and peaceful, rich in natural resources. My hat's off to our British cousins for doing a masterful job of governing and improving conditions. They are keenly aware of the need for the best in sanitation!

Yes, even the natives of Borneo have their auditorium! Their communication system is a mystery, but somehow must have picked up one of the flashes from the "Flagship of the Sangamon Fleet."

The island was in Jap possession from 1942 to 1945, and they left it completely devastated. The British are reconstructing the cities and it's my job to advise, set standards of practice and consult on the design of the new water and sewerage systems. The entire future and economy revolve around health protection and proper sanitation.

The jungle areas are inhabited by two tribes, the Dusans and Marats (latter the famous head-hunters); the cities principally by Malaysians and Chinese.

Hope to be back on the job in Springfield by the middle of March, returning through Hongkong, Siam, India, Italy, Switzerland to New York. I came via San Francisco, Hawaii and Manila—41¼ flying hours from Springfield. The world is a small place!

CLARENCE W. KLASSEN

We are admonished to be free from fear, but there are three fears we might retain with profit, namely, Fear of God, Fear of strong drink, and Fear of debt. — Ruth Smeltzer.

Automobile Facts

I hold every man a debtor to his profession; from the which as men of course do seek to receive countenance and profit, so ought they of duty to endeavor themselves by way of amends to be a help and ornament thereunto.

Sir Francis Bacon

Tentative Program 69th Annual Meeting

(Subject to Change)

EAST ST. LOUIS, ILLINOIS MARCH 25-26-27, 1954 HEADQUARTERS—BROADVIEW HOTEL

Big plans are afoot in the St. Clair Chapter as the following program for the Annual Meeting indicates, for both members and wives. Come and bring your best friend with you. All roads lead to East St. Louis March 25-26-27. The 69th Annual Meeting will convene at the Broadview Hotel. The registration desk will be open Wednesday evening, March 24th, until 10 p. m. Come early. Don't miss the luncheon meeting Thursday noon. A splendid program has been arranged. Your local committee is doing everything possible to provide for your pleasant stay in our community. You will receive by mail further information. When you receive the post card to indicate your choice of hotel accommodations, please return same at your early convenience. This will greatly assist us in serving you.

LADIES' PROGRAM

Wednesday, March 24

7:00 p.m. to 9:00 p.m.—Meet and Greet—Mrs. Earl W. Markwardt, Chairman.

Thursday, March 25

8:00 a.m. Registration—Mrs. Melvin Dobbs, Chairman; Mrs. Charles Manion, Co-Chairman.

8:30 a.m. Meet and Greet Room Open—Play Cards, Chat with Friends or Shopping.

12:00 Noon Luncheon with Men—S. C. Casteel, Master of Ceremonies.

SEE MEN'S PROGRAM

2:00 p.m. Surprise Speaker
Card Party—Mrs. F. G. Olbrich, Chairman;
Mrs. S. Daniels, Co-Chairman.

5:00 p.m. Refreshments with Men, courtesy Portland Cement Association.

6:30 p.m. Smörgåsbord and Entertainment.

Friday, March 26

8:00 a.m. Registration.

9:00 a.m. Breakfast—Mrs. S. C. Casteel, Chairman;
Mrs. D. H. Murphy, Co-Chairman.

Speaker: Mrs. Jeannette Elliott of Television Station WTVI. Topic: "Mad Hatter."

11:00 a.m. Auxiliary Meeting—Mrs. D. J. Johnston, presiding.

Introduction—T. Carr Forrest, Jr., President of N.S.P.E.

Reports from Auxiliaries Nos. 1, 2, and 3.

12:30 p.m. Bus Trip to St. Louis. Lunch, Surprise Entertainment—Mrs. G. W. Kennedy, Chairman; Mrs. D. J. Johnston, Co-Chairman.

5:30 p.m. Refreshments with Men.

7:00 p.m. Banquet with Men—Fred J. Meek, Master of Ceremonies. (Dress Optional); Dancing.

SEE MEN'S PROGRAM

Saturday, March 27

9:30 a.m. Meet and Greet Room Open. Entertainment will be arranged.

12:00 Noon "Dutch Treat" Lunch.

1:15 p.m. Adjourn.

Prizes — SURPRISES — Souvenirs

MEN'S PROGRAM

Thursday, March 25

MORNING

7:30 a.m. Board of Direction Breakfast.

8:30 a.m. Board of Direction Executive meeting.

NOON

12:00 Noon Luncheon—S. C. Casteel, Master of Ceremonies. Formal opening of Annual Meeting with ladies present.

Invocation—Rev. Arthur B. Smith, Pastor,
First Presbyterian Church, East St.
Louis, Illinois.

Introductions—A. J. Feickert, Chapter President,
R. J. Brichler, State President.

Welcome—Hon. Alvin G. Fields, Mayor of East St.
Louis, Illinois.

O. D. Meyer, President, East St. Louis
Chamber of Commerce.

Address—Lt. Gen. Robert W. Harper, Commander,
Air Training Command, U.S.A.F.

AFTERNOON

2:00 p.m. Board of Direction meeting, R. G. Brichler presiding.

Escorted Tours—Choice of Monsanto Chemical Company, Aluminum Ore Company, Scott Air Force Base.

5:00 p.m. Refreshments—Courtesy Portland Cement Association.

6:30 p.m. Smörgåsbord and Entertainment.

Friday, March 26

MORNING

9:00 a.m. General Assembly, R. G. Brichler presiding.

9:15 a.m. Address by Clarence W. Klassen on recent experiences in Borneo and Far East.

10:00 a.m. Business meeting.

NOON

12:00 Noon Luncheon, R. G. Brichler presiding.

Address by Vera M. Binks, Director of Department of Registration and Education.

Address by T. Carr Forrest, Jr., National President,
N.S.P.E.

(See next page)

AFTERNOON

- 2:30 p.m. Business meeting.
 5:30 p.m. Refreshments.
 7:00 p.m. Banquet—Fred J. Meek, Master of Ceremonies.
 Invocation—Rev. James Bernard Macelwane, S. J., Dean of Institute of Technology, St. Louis University.
 Introductions—State President, R. G. Brichler; National President, T. Carr Forrest, Jr.
 Address—Dr. Curtis L. Wilson, Dean of Mines and Metallurgy, University of Missouri.

Saturday, March 27th

- 9:00 a.m. Business and organization.
 12:00 Noon Luncheon.
 1:15 p.m. Adjourn.

PARTIAL LIST OF LADIES' COMMITTEES
FOR ANNUAL MEETING

(Prepared by MRS. D. H. MURPHY)

The coming ISPE Convention is the first one held in Illinois which will be served by a Ladies' Auxiliary. The chairman and co-chairman have prepared letters of invitation which are being sent to the wives of members all over the State. They are making vast and interesting plans to insure that ladies who come to East St. Louis with their husbands will find an interesting and entertaining time during the convention period. To that end, Mrs. Brichler, chairman, and Mrs. Feickert, co-chairman, have appointed the following committee heads:

Reception Committee

Mrs. Earl Markwardt, Chairman

Registration

Mrs. Melvin Dobbs, Chairman

Mrs. Charles Manion, Co-Chairman

Card Party

Mrs. F. G. Olbrich, Chairman

Mrs. Sam Daniels, Co-Chairman

Breakfast

Mrs. Stephen Casteel, Chairman

Mrs. Devereux H. Murphy, Co-Chairman

St. Louis Luncheon

Mrs. G. W. Kennedy, Chairman

Mrs. David Johnston, Co-Chairman

Decorations

Mrs. Fred R. Friedewald, Chairman

The officers of the Ladies' Auxiliary, besides Mrs. Johnston, who is president, are: Mrs. Earl W. Markwardt, Vice President; Mrs. Stephen Casteel, Secretary; and Mrs. William S. Krause, Treasurer. Mrs. Ralph R. Hodges is General Publicity Chairman and Mrs. Devereux H. Murphy is Convention Publicity Chairman for the Women's Activities.

Membership of other committees will appear in the March issue.

NOTES TO THE LADIES

(Prepared by MRS. DEVEREUX H. MURPHY)

The Ladies' Auxiliary to the St. Clair Chapter of the ISPE are planning a "Meet and Greet" room at the Broadview in East St. Louis. Coffee will be served and every opportunity will be given to meet new friends and greet old ones. So Ladies, do plan to come and attend the convention with your husbands.

What game do you play? Bridge, Canasta, Auction, Pinochle, "Dirty 8" ??? The Ladies' Auxiliary is planning a lovely card party for your entertainment while you are here, attending the 69th Annual Convention of the ISPE.

Have you ever attended a "Mad Hatter" breakfast? One is being planned for you when you attend the 69th Annual Convention of the ISPE at the Broadview in East St. Louis on March 25, 26 and 27. Your bonnet will be a very important part of your fun at the breakfast. Surprise entertainment here, too . . .

We don't mean to steal the men's thunder, but we peeked . . . and found that they are planning some very nice things for their convention at East St. Louis on March 25, 26 and 27. Cocktail hours? Like them? Lunches? Hmmm? The banquet . . . Believe me, girls, you'll be sorry if you let them come alone and have all the fun . . .

Letters of invitation are being sent to the wives of members of the ISPE all over the state. Just in case yours is mis-sent, or mislaid, or lost in the mails, do consider this an invitation to attend the ISPE State Convention with your husband at the Broadview in East St. Louis on March 25, 26 and 27. Park the kiddies with Grandmother and have a second honeymoon.

69th Annual Meeting

Broadview Hotel

East St. Louis

MARCH 25-26-27, 1954

The Impact of Oil On Our Economy

DR. GUSTAV EGLOFF, Member N.S.P.E., Chicago Chapter

Director of Research, Universal Oil Products Company, Des Plaines, Illinois.

The following paper is an excellent survey of the present status of the petroleum industry. It was originally presented before the Bond Club of Chicago and subsequently submitted to the Society for publication in the ILLINOIS ENGINEER. Dr. Egloff, a leading petroleum scientist and one who has received much recognition and many honors in the engineering world, presents a word picture of the amazing changes that the oil industry has wrought in our way of living during the past half century.

W. A. OLIVER, Editor

Introduction

The petroleum industry is a characteristically American enterprise. Its growth has been highly instrumental in the rise of the United States to the most industrialized of all nations. Investments in petroleum facilities are now \$43 billion, which places the industry in third place. The amount of money invested in the natural gas industry is now around \$9 billion. Agriculture leads all industries with investments of \$170 billion and public utilities are second with \$52 billion. Railroads have dropped to fourth place with estimated assets of \$36 billion.

United States wells produce over half the world's oil, and we are the largest users of petroleum products both in total volume and per capita. The 1952 domestic demand for all petroleum products was 2,665,000,000 barrels. Our population January 1, 1953, was 158,500,000, so that the per capita consumption was 707 gallons per year. The industry's methods of finding, producing, transporting, refining, and marketing are highly developed and are being constantly improved by research.

Another highly important segment of the oil industry is the petrochemical industry which, starting only thirty years ago, now represents a total plant investment of \$2.5 billion with probable expansion of \$400 million in 1953. Over 17 billion pounds of petrochemicals per year are being produced at present and within less than ten years, it is anticipated that production will be 64 billion pounds or 50 per cent of the total chemical production in the United States.

At present nearly 20,000 highly-trained research personnel are engaged in developing new processes and products and the industry's annual research budget totals over \$130 million. Through the years the oil industry has been marked by rapid expansion. Since 1946, the industry has spent over \$20 billion for facilities to satisfy the unprecedented requirements for its products.

It may be asked whether this great expansion and increasing dependence on petroleum-derived products is built on a solid foundation of adequate raw material reserves. Despite periodic gloomy predictions as to its reserve supplies of oil, the known reserves have been maintained in the face of ever-increasing demands. Estimates of ultimate world reserves of 1,500 billion barrels and United States reserves of 120 billion barrels have been made, but these are probably far too low. Evidence is being found that petroleum is still being formed in

marine sediments and it may be that its rate of formation is higher than consumption.

Oil and Our Total Energy

The development of our vast oil and gas resources has revolutionized our energy sources within fifty years' time. During the period from 1900 to the present when our population has increased from 76 million to over 158 million, our total power requirements have actually quadrupled. The power derived from oil, however, has increased 38 times and that from natural gas 28 times while that from coal has only doubled. Table I contains data on the power developed from coal, oil, natural gas, and water power in 1900 and 1950 on an absolute and a percentage basis.

TABLE I
U. S. Power Sources

Source	1900		1950		Times Increase Over 1900
	Trillions of Btu's	Percent of Total	Trillions of Btu's	Percent of Total	
Coal.....	7.02	88.9	14.65	41.3	2.1
Oil.....	0.33	4.5	12.44	35.1	38
Natural Gas.....	0.24	3.2	6.75	19.0	28
Water Power.....	0.24	3.2	1.57	4.4	6.5

The data show that the most pronounced increases have come from oil and natural gas which now account for 54% of the power developed, compared to only 41.3 per cent from coal. The curves of oil and gas usage are still rising steeply. Their increased use has been the result of several factors. Primarily they are more easily handled than coal and hence save labor. They are cleaner and more efficient in furnaces and have underbid coal in price. Another factor favoring oil and gas has been the labor strikes which have frequently plagued the coal industry and rendered supplies unreliable at critical times.

A significant element in this change from coal to liquid fuels is the space heating market. As late as 1935, 80% of residential and commercial heating was done by solid fuels. In that year only 10% of space heating was done with liquid fuels. By 1951 the percentage of heating by solid fuels dropped to 43%, while that done by oil and gas had risen to 54%. The same general advantages in petroleum fuels compared with coal in space heating are evident as were noted in power generation. The petroleum fuels are cleaner, more easily handled and

cheaper on a thermal basis. Table II shows the heat (British Thermal units) obtained from different fuels for a dollar expenditure.

TABLE II
Cost Comparison for House Heating

FUEL	BTU PER DOLLAR
Gas.....	625,000
Oil.....	510,000
Coal.....	470,000

The use of liquefied petroleum gas for cooking purposes is growing rapidly in farm and other areas where city gas is not available. Also it is well to remember that 4 million rural homes in the United States are still lighted by kerosene lamps, and that 68% of our present production of kerosene is used for cooking.

Transportation

The most far-reaching effect of the use of petroleum fuels has been in the field of transportation which has completely altered every aspect of life from international relations to the schoolboy's Saturday night date. In 1900, 8,000 automobiles were registered, all passenger cars. The first airplane flight was yet to be made. Today the roads are crowded with 44 million passenger cars and 9 million trucks and buses, and registered civil aircraft number 90,000 in the United States to say nothing of warplanes. The effect on our economy of faster travel and transport has been enormous and has been possible mainly because of the large quantities of gasoline, diesel fuel and lubricants which the petroleum industry has made available. The production of gasoline in the United States was 1,190,000,000 barrels in 1952.

The high gasoline demand has been met both by increasing crude oil production and by new processes for increasing the yield of gasoline. In 1910, with 500,000 autos on the highways, total crude oil production was about 210,000,000 barrels compared to over 2 billion at present. At that time, the total gasoline yield was only 12 per cent. Through the use of cracking and related processes the total gasoline yield has been raised to over 45 per cent.

The problem of quality, however, was only a part of the challenge which the oil industry has had to meet. Mechanical improvements have been made and engine efficiency has been increased by raising compression ratios. When cracked gasoline appeared on the market the compression ratio of automobile engines was around 4.5 to 1 and there was no knocking with any fuel. As compression ratios were increased, knocking was encountered, but fortunately cracked gasoline has better anti-knock properties than the natural or straight-run product. The average compression ratio of today's automobile is 7.5 to 1 and the 1953 Buick has a compression ratio of 8.5 to 1, which requires premium fuel of 94 octane. An experimental car has been built with a 12 to 1 compression ratio engine which will need 100 octane fuel.

The oil industry has always been able to meet this increasing demand in quality. First with the development of thermal cracking from which gasoline as high as 80 research octane could be obtained, then through auxiliary processes and catalytic cracking. Polymerization, the first of the auxiliary catalytic processes to be developed, yields gasoline of about 90 research octane from refinery gases and thus also increases gasoline yield per barrel of charge from 2 to 5 per cent. Alkylation, another catalytic process based on refinery gases, made possible the production of 100 octane gasoline. Catalytic cracking which came into wide-scale commercial development only at the beginning of World War II, produces gasolines with 88 to 90 research octane and as high yields as thermal cracking. Even with these processes, refiners would find it difficult to fulfill the demand for high octane fuels if it were not for recent installations of another type of process called catalytic reforming in which low octane gasolines are upgraded to gasolines which upon addition of tetraethyl lead have octane numbers of 95. The commercial development of UOP Platforming, a catalytic reforming process, is an excellent example of the rapidity with which the oil industry moves to meet demands. Announced in March, 1949, this process is now operating in 22 units with a throughput of about 80,000 barrels per day and a total of 58 units with daily capacity of 309,000 barrels have been contracted for.

The summary effect of these developments is tremendous. The use of the thermal and catalytic processes has made unnecessary the production of 40 billion barrels of crude oil since the first cracking units were installed in 1913. At present the saving from both greater quantities and better qualities of fuels is saving about 2 billion barrels of oil per year. When the 12 to 1 compression ratio engines which require 100 octane gasoline come on the market, motorists will obtain 40 per cent more miles per gallon than they average today. At the present level of consumption and price of gasoline, this savings would amount to \$4.5 billion per year.

The role of high quantities and qualities of gasoline in the development of aviation has been as vital as in automotive transportation. Without the enormous supplies of 100 plus fuel made possible by the alkylation process during the last war, victory would have been impossible. The German Messerschmitts in the battle for Britain were fueled with 91 octane number gasoline while British Spitfires used 100 octane gasoline and were enabled to outfly and outmaneuver the German planes. Aviation is now dependent upon adequate supplies of even higher performance rating gasoline. In the three years from 1949 to 1952 the production of aviation gasoline in the United States increased from 128,700,000 to 203,000,000 barrels per year and military specifications run as high as 115/145 performance rating. Our commercial fleets which flew over 12,350,000,000 passenger miles and 254,188,642 ton freight miles in 1952 would not be possible without adequate supplies of high octane gasoline.

Jet-propelled planes present new fuel problems to the oil industry. The fuel needed for the turbines of jet planes must have high heating value per unit weight, low carbon forming tendencies and low freezing point because of the low temperatures at the high altitudes of 7 or 8 miles where the planes operate most efficiently. These requirements point to kerosene or light gas oil and heavy ends of gasoline as the best fuel. The use of jets in aerial warfare attests to the improvements in jet fuels that have already been made and the intensive research now going on is sure to bring forth fuels which will make commercial operation profitable.

Another fuel of major importance in our vast transportation system is diesel fuel. It is used in many of the trucks and buses on the road and by a large proportion of railway locomotives. The rapid dieselization of railroads is most spectacular. The first diesel engine in railroad history was put in service on the Burlington in 1934. In 1945 the number had climbed to 3,816 and at the present time railroads have 21,000 diesel locomotives in service and 20 out of 140 class one railroads are completely dieselized. In 1952 diesel electric locomotives accounted for 65% of the gross ton miles of all railroads, with coal-burning steam locomotives accounting for 27%, oil-burning steam locomotives 7%, and electrical locomotives 1%.

The reasons for rapid acceptance of diesel locomotives are numerous. The fuel efficiency of a diesel locomotive is 26% compared with 7% for a steam engine. Diesel locomotives are much longer lived than steam. The first Burlington diesel is still in service after 2.5 million miles of travel, while the average steam locomotive is sent to the scrap heap after 1.5 million miles. Another important consideration is that a diesel locomotive requires no water so that watering stations are eliminated. It is being considered by some diesel locomotive builders that 35,000 engines represent the saturation point for the railroads.

Agriculture

The impact of the oil industry is perhaps greater upon agriculture than on any other phase of our economy. When the oil industry began, about 100 years ago, 65% of the gainfully employed were in agriculture, while at present less than 15% are so employed. The use of petroleum products in the present types of farm machinery has been a major factor in the increased efficiency of agricultural operations. The farmer is the best customer of the oil industry, which is vitally interested in the farmer's welfare. Petroleum has contributed not only to the mechanization of farming, but also to the provision of various chemical products such as fertilizers, insecticides, weed killers, and a host of other products which have caused a complete revolution in agricultural methods.

In 1915 there were 26,000,000 horses and mules on our farms. The increasing use of tractors for all types of farm operations has resulted in almost complete elimination of horse-drawn equipment and has drastically

reduced the hours of manual labor formerly required. In 1952 the number of horses and mules had been reduced to 6 million, while 4.2 million tractors were being employed in place of 20,000,000 animals for various purposes, such as plowing, harrowing, fertilizing and soil preparation, as well as seeding, cultivating, and harvesting. Substitution of tractors for horses and mules has released much former pasture land for growing crops for human consumption so that we eat better in consequence. Where irrigation is required power is derived from diesel and gas engine driven pumps. The energy derived from oil fuels on farms is estimated at 750 million horsepower, more than the total employed in all other industries. The tractors and trucks owned by farmers consumed over 295 million barrels of gasoline in 1952. Besides tractors and trucks, other mechanized equipment on United States farms includes 887,000 combines, 588,000 corn pickers and 686,000 milking machines.

A striking development of the past decade has been the use of airplanes in farming. Originally employed for dusting crops with insecticides, airplanes are now employed for seeding, weed killing, fertilizing, and defoliating operations. At the present time there are about 9,000 specially designed and equipped airplanes in agricultural service. Some 1,800 companies are now doing custom work for farmers. The use of helicopters is increasing because of their ability to fly slowly and close to the ground. The labor and time saving by the use of planes is almost past belief. Operations such as rice seeding, cotton dusting, fertilizer application and weed control, which ordinarily require from 30 to 60 man hours of labor per 100 acres can be taken care of in half an hour using airplanes.

The growing petrochemical industry has almost equally great implications on agriculture. Petroleum and natural gas are supplying hydrogen for the manufacture of ammonia, an essential plant food. The ammonia is frequently injected into irrigation waters or it may be made into ammonium nitrate or sulfate and applied dry. Our total ammonia production is now around 2 million tons a year and 75% of this is made using hydrogen from natural gas. By 1960 it is anticipated that annual production of ammonia from natural gas will amount to 3.3 million tons.

Petroleum furnishes hydrocarbons needed in manufacturing such general-purpose insecticides as DDT, BHC, Chlordane, and Aldrin. The results obtained by large-scale employment of these insecticides are spectacular to say the least. They have rid farm areas of mosquitoes, flies, beetles, and grasshoppers. Invasions of locusts in the Middle East have been completely routed by the use of Aldrin spread from low-flying planes. In one instance, 53,000 acres were completely rid of locust infestation in a short time. There are some 80,000 species of insects in the United States and these may reach concentrations of 15 million per acre of cultivated ground. Annual crop and livestock losses to insects in the United

States are around \$4 billion. Eventually these losses will be completely eliminated by the systematic use of insecticides.

Ridding animals of irritating insects results in more meat and in the case of cows in 20% higher yields of milk. About 130 billion pounds of milk are produced annually in the United States and the 20% increase would be 26 billion pounds if insects were eliminated from cows. Estimates indicate that the annual loss in meat due to insects is around \$500 million. In some cases steers have gained 50 extra pounds in weight when kept free from insect irritation. Experiments are in progress involving 10,000,000 range cattle to determine the benefits accruing if the steers are kept free from the annoyance of flies. Proportional weight increases have been noted when the skin of hogs has been greased to prevent insect irritation.

Chemicals based on petroleum are effective against fungi and plant diseases. The vapors of benzene or its dichloro derivatives prevent mildew in young cabbage plants and tobacco seedlings. Crop losses from fungi and other plant diseases are around \$4 billion a year so the elimination of these losses is a very worthwhile project.

Chemicals manufactured from petroleum hydrocarbons are also used as fumigants on stored grain and cereals. Among these are ethylene dibromide, methyl bromide, allethrin, and nitro paraffins. Another pest which causes catastrophic losses of food in storage is the rat. It has been estimated that the 300 million rats in the United States account for the loss of food per year of \$1.25 per person. A rat in a hotel eats \$5 worth of food every year. Some of the rat poisons which have been found effective in control measures are based on petroleum products.

Losses in crops due to weeds amount to \$5 billion a year. It has been estimated that without weeding only 7 bushels of corn are obtainable per acre of ground where with complete weeding the yield can be 53 bushels. In the field of weed killers, petroleum hydrocarbons are used in the manufacture of the well known 2,4-D and the recently developed 2,4,5-T, which are used as selective herbicides for broad leaf plants. Fractions of petroleum have also been used as sprays to rid carrots of growth-strangling weeds. In some instances weeds are killed by direct burning with oil flames. Present annual expenditures for weed killers are around \$35 million.

The soil fumigant D-D is recovered as a by-product in the manufacture of synthetic glycerin. This mixture of chlorinated hydrocarbons is injected into soils infested with wireworms and nematodes. The fumigant not only kills the soil worms but leaves their carcasses as fertilizer. It has been estimated that 2 million acres or 3,000 square miles of farm land in Southeastern United States are in need of soil fumigation before satisfactory crops can be obtained.

With half the world's population on an inadequate diet, the losses in food to insects, plant diseases and weeds

seem quite intolerable. Even in the United States where agriculture is on a high technical level, the present loss in crops and meat is about \$83 a year per capita, and the total loss is roughly equivalent to the labor of 4,000,000 farm workers.

The petroleum industry is keenly aware of its opportunities for improving the efficiency of farming and livestock raising. The Shell Oil Company has an experimental farm at Modesto, California, comprising 142 acres, in which petroleum products are tested on grains, vegetables, vines, and trees. A similar project is being set up in Venezuela.

Other Petrochemical Products

The petrochemical industry has not only made available large new sources of materials on which to base products but has also served as the basis for many new substances to replace dwindling supplies of metals and such natural materials as glass, wood, fibers, leather and ceramics. In many instances, petrochemicals have been the basis for entirely new products that could not be fabricated from natural materials.

The plastics industry is a good example of a gigantic enterprise made possible by this relatively new supply of materials. In 1955, annual production of plastics is expected to reach 4.6 billion pounds, about twice present production and by 1975 may be a 25 billion pound industry. These products range from large molded parts to paints and other coating materials. Through development of new and improved types, materials are developed to meet the requirements of our constantly changing existence. As an illustration, a 300-pound cast iron bath tub is hardly suitable for use in trailers which have in late years become the permanent homes of millions of Americans. Through the use of laminated plastic glass fibers, tubs weighing only 15 pounds have been made for this use. Another entirely new type product is plastic pipeline. These pipelines have advantages over metallic pipelines in that they are lighter in weight, resistant to corrosive chemicals, acid and alkaline soils, salt water, and vibration, and have high impact strength and flexibility. Plastic pipelines are also a good example of the rapid development of new markets. First coming into commercial use in 1948, they are expected to be a \$20 to \$30 million market this year and in the \$250 million range by 1960.

The development of new synthetic materials in ample quantities also has great import in making our nation self-sufficient. The synthetic rubber industry best illustrates this point. The quantities which are available and the quality of the rubber now being made leaves us independent of imported supplies of natural rubber. This industry is almost entirely dependent upon petrochemicals, 2.5 billion pounds of them being used annually at present.

The non-rayon synthetic textiles, including Nylon, Dacron, Dynel, Acrilan and Orlon, are having many effects on our economy. Last year (1952) production

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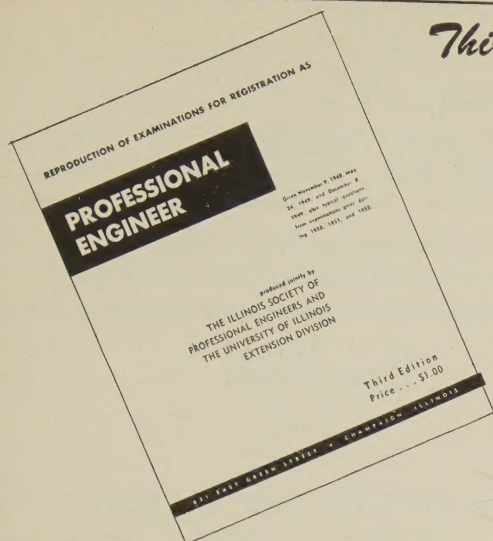
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was 260 million pounds and when projected plant capacity is completed in 1957, production will be about 600 million pounds. These synthetics will then account for almost 10 per cent of the total textile market. Their inherent properties stand to bring about other changes in both textile markets and service industries. They wear longer and are lighter in weight. The optimistic conclusion from these facts is that man will be better clothed rather than that textile consumption will decrease. Their resistance to wrinkles, moths, and mildew and their fast-drying property dispense with the need for many services. They are a boon to the manufacturer in that he is working with a tailor-made product that does not vary with the quality of crops nor the health of animals as do natural fibers. Colors can be matched in dyeing nylon rugs whereas wool varies in the color it takes. As with plastics and rubber, the new fibers have made possible products heretofore unknown. The most dramatic of these is the armored nylon vest which has been credited with reducing chest and abdominal wounds by 60%.

Another major petrochemical market is synthetic detergents. With production beginning only in 1940, the synthetic detergents have taken away about half of the total soap market. Consumption of the detergents increased 21.9% last year while soap declined 9.1%. The importance of synthetic detergents, however, goes far beyond their effect upon the soap industry. These products like fibers, rubber and plastics are tailor-made for specific purposes and improvements are constantly being made.

Petrochemicals also include many of the high-tonnage industrial products such as acetone, alcohols, ethylene glycol (anti-freeze), and formaldehyde which were formerly supplied entirely from other raw materials. The shift in raw materials has been necessary because supplies of the former source materials were inadequate to meet present requirements. The result has been one of stable supplies and, in many instances, lower prices.

Over half of the industrial ethyl alcohol, for example, is now petrochemical and is not subject to the fluctuating price nor availability of molasses. The range of products available from petrochemicals varies from methionine, one of the B vitamins, to TNT, and the list is growing. It is reported that 500 new petrochemicals went on the market in a recent 12-month period.

Other factors concerning the oil industry have also had widespread influence on our economy. Its inventions have been applied to other industries. The fluid technique for handling solids, which was developed in connection with the Fluid Flow Catalytic Cracking Process, has been applied to a wide range of procedures such as the recovery of metal from low-grade ores, the manufacture of phthalic anhydride, and the burning of limestone. The oil industry also creates large-volume business for other industries. For example, it utilizes one million pounds a day of cracking catalyst alone.

The impact of the oil industry on our economy will be even greater in the years to come. It has the kind of faith in our future that assures continuous progress and achievement.

IS THE NEXT STEP CIVIL SERVICE?

R. A. LONIER, Editor, *Illinois Highway Engineer*

The Illinois Association of Highway Engineers has endeavored for years to find a stable and workable solution to the economic and professional problems of the engineers of the Illinois Division of Highways. Studies were made and plans submitted many times for consideration to the personnel policy makers in State Government. Cost of living increases were obtained from time to time but not until 1950 was there any real action taken to resolve the basic problems of the engineers.

Two years were spent in bringing about adjustments in inequalities that had developed during the World War II period. Then in 1952, after almost three years of study and hard work by a personnel advisory committee of the

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Illinois Division of Highways, a personnel policy was put into effect which gave promise of fulfillment of all the past efforts of the IAHE.

The new policy gave the engineers a more equitable method of performance rating and a system of annual and semi-annual salary increases in every classification based on merit. For the first time the engineering graduate could be promised something more than a starting salary, and those engineers already with the department given the incentive to remain and make highway engineering their life's work.

However, administrative policies can be changed, and the personnel policy which was in effect in 1952, was no exception, for it has since been greatly curtailed.

The younger element among the members of IAHE has been growing rapidly and there are rumblings from

them of dissatisfaction regarding the effectiveness of the older members holding office in their efforts to improve the economic welfare of highway engineers. In many instances this feeling of dissatisfaction is justified. Leaders who do not back their men are not leaders—leaders who take more than they give are not leaders—leaders who do not inspire are not leaders. They should retire.

—Illinois Highway Engineer

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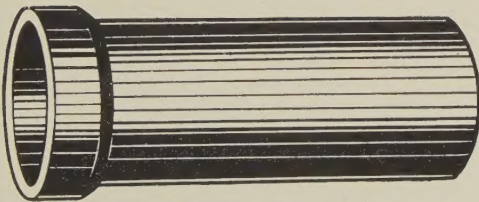
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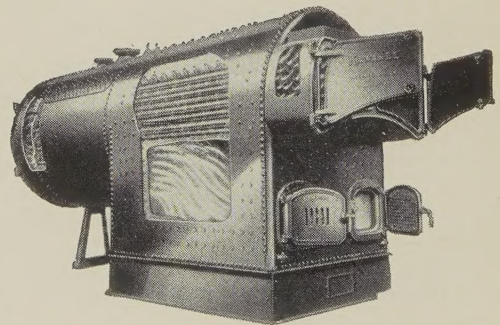
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Plant Mgr. I.E. 30. Six mos. resp. for wage incentives and cost control. One yr. doing methodization and procedures. Two yrs. design development and process sheets. Three yrs. supervising in the application of labor

and quality control plans. \$7200. Midwest. 797-PE

Municipal Eng. C.E. 36. Thirteen yrs. resident engr. charge of lines, grades, inspection and records in the field on sewer projects. Four yrs. charge of survey platoon. \$5500. Chicago. 798-PE

Factory Mgr. 42. One yr. ch. tool engr. Two yrs. tool up new appliances and changes on existing appliances. Eight yrs. complete charge of plant exclusive of accounting and financial resp. \$9000. Chicago. 799-PE

Designer. M.E. 30. Seven yrs. general engineering design, drafting of heating equip., conveyor systems, and component parts. \$5700. Chicago. 800-PE

Sales Eng. B.A. 39. Three yrs. inspector of metal items. Four yrs. handling sales, correspondence, and direct selling on stamping and sheet metal products. \$4800. Midwest. 801-PE

Sales Engr. Gen. Engr. 29. Fifteen mos. sewer design and drafting. Fourteen mos. sales engr. calling on architects, and engineers. Wrote specs. and made take-offs and promotional selling on plumbing and heating. \$5200. Chicago. 802-PE

POSITIONS AVAILABLE

Manager—Metals Res. Dept. B.S., M.S. or Ph.D. preferred. Age: 35-50. 10 yrs. exp. in research and development exp. in metallurgy. At least 3 of 10 yrs. in administrative capacity. Knowledge of above. Duties: organization and management of research dept. of 100-120 metallurgists and technicians engaged in all fields of metallurgical research and development work. For a service res. organization. Salary: \$10-\$16,000. Employer will negotiate fee. Loc.: Chicago. C-1572

Construction Superintendents. 3 plus yrs. exp. in steel or concrete construction of buildings and knowledge of Spanish and Spanish constr. Knowledge of correlating Spanish trades. Duties: Construction supt. in charge of building commercial type buildings. For a retailer. Salary: \$8-\$10,000. Employer will pay fee. Location: Mexico and Peru. C-1564

Mechanical Designer-Project Engineer. Age: 30-50. 5 plus yrs. exp. in design of small mass production items and preferably in plastic molded parts. Knowledge of production tools, fixtures, and costs. Duties: design of mechanical new products in metal and plastic parts of electrical equipment. Mostly electro-mechanical assemblies. For a manufacturer of electrical equipment. Sal-

ary: \$6-\$9000. Loc.: California. C-1559(a)
Research and Development. E.E. Age: open. 3 plus yrs. exp. in general radio or T.V. Plus 1 yr. of color development. Duties: research and development on colored T.V. For a manufacturer of electrical equipment. Salary: \$6000-\$11,000. Employer will negotiate fee. Location: California. C-1559(b)

Supervisor—Welding Research. B.S., M.S. or Ph.D. in Metallurgy preferred. Age: 28-50. 5 yrs. exp. research and development exp. in welding including arc, resistance and gas welding, brazing and soldering. Duties: supervise staff of 5 engrs. and 5 technicians; responsible for technical direction of all welding research programs. Promote new projects in welding field. For service research organization. Salary: \$700-\$900. Employer will negotiate fee. Limited traveling. Location: Chicago. C-1546

Design and Operating Engineer. Knowledge of steel mill design and operations. Duties: advise operating company on two oil-burning open-hearth furnaces, traveling cranes and other steel mill equipment either damaged or destroyed in Korean conflict. For steel manufacturer. Salary: \$12,000 plus subsistence. Location: Korea. C-1532

Electronic—Research. Over 28 yrs. of age. 5 plus yrs. exp. in design on small mechanism circuitry or tape recorders. Knowledge of circuitry work. Duties: Research and development on tape and wire recorders. For a manufacturer of electrical equipment. Salary: \$600-\$750 per month. Employer will negotiate fee. Location: Chicago. C-1528

Development—Aeronautical. A.E. or better. 8 plus yrs. exp. in structures' work on heavy bombers or heavy commercial planes. Duties: research and development on heavy aircraft structures. For a manufacturer of electronics. Salary: up to \$15,000 per yr. Employer will negotiate fee. Location: Chicago. C-1524(b)

Chemical Engineer. Chem. Engr. or Chem. Age: up to 40. 3 plus yrs. exp. in chemical engineering involving adhesives, plastic films or plastic packaging. Knowledge of inorganic chemistry. Duties: research and development of new plastic adhesives for industrial uses. For equip. manufacturers. Salary: \$600 per month. Loc.: Chicago. C-1561(a)

Chemical Engineer-Lacquers. Chem. Eng. or Chem. Age: up to 40. 3 plus yrs. exp. in developing lacquer, resin or paint linings. Knowledge of inorganic chemistry. Duties: research and development on lacquer linings. For a manufacturer of equipment. Salary: \$600 per mo. Location: Chicago. C-1561(b)